Assesment Report

on

"Customer Segmentation in E-commerce"

submitted as partial fulfillment for the award of

BACHELOR OF TECHNOLOGY DEGREE

SESSION 2024-25

in

CSE(AIML)

By

Yashi Kesarwani (202401100400219)

Under the supervision of

"Abhishek Shukla"

KIET Group of Institutions, Ghaziabad

Affiliated to

Dr. A.P.J. Abdul Kalam Technical University, Lucknow

(Formerly UPTU)

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Introduction

In the fast-evolving e-commerce industry, understanding customer behavior is crucial for sustaining competitive advantage and driving business growth.
Customer Segmentation in E-commerce: Identifying customer clusters based on purchasing habits and browsing behavior forms the core of this project.

By strategically analyzing customer purchasing patterns and browsing activities, businesses can personalize marketing efforts, optimize customer retention, and significantly enhance profitability.
This project aims to **accurately** segment customers into meaningful groups by using real-world e-commerce transaction data — ensuring that the clustering captures behavior patterns with a focus on **maximizing segmentation accuracy** through appropriate data preprocessing, feature scaling, and model selection techniques.

Through this segmentation, organizations can develop highly targeted strategies that cater to specific customer needs, thereby improving both customer satisfaction and operational efficiency.

Methodology

1. **Data Upload:**

   The provided dataset containing transaction details like InvoiceNo, StockCode, Description, Quantity, InvoiceDate , UnitPrice , CustomerID, and Country was uploaded using Google Colab's files.upload() function.

2. **Data Preprocessing:**

   - Removed missing CustomerID values.
   - Filtered out transactions with negative quantities (considered as returns).
   - Created a new feature TotalPrice = Quantity × UnitPrice.

3. **Feature Aggregation:**

   Customer-level features were generated:

   - Number of Orders
   - Total Quantity Purchased
   - Total Amount Spent

4. **Feature Scaling:**

   StandardScaler was applied to normalize the numerical features for better clustering results.

5. **Cluster Identification:**

   Used the Elbow Method to determine the optimal number of clusters. K-Means Clustering was then applied to segment the customers into meaningful groups.

6. **Visualization:**

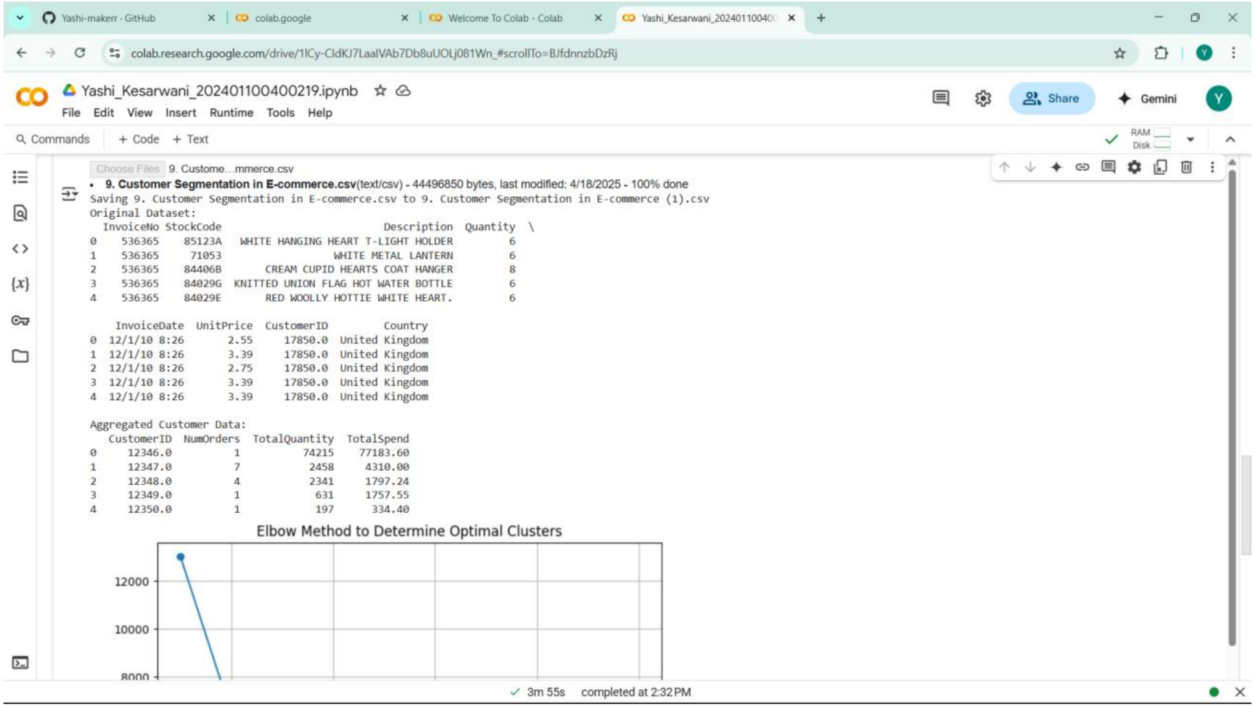
   Visualized customer clusters using Seaborn scatter plots, highlighting patterns based on total spending and quantity purchased.

CODE:

```
# 1. Import libraries
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.cluster import KMeans
from sklearn.preprocessing import StandardScaler

# 2. Upload CSV file (Colab / Jupyter style)
from google.colab import files
import io

# Upload the file
uploaded = files.upload()

# Read the uploaded CSV
for file_name in uploaded.keys():
    df = pd.read_csv(io.BytesIO(uploaded[file_name]), encoding='ISO-8859-1')

# 3. Display the data
print("Original Dataset:")
print(df.head())

# 4. Data Cleaning
# Remove missing CustomerIDs
df = df.dropna(subset=['CustomerID'])

# Remove negative quantities (which are returns)
df = df[df['Quantity'] > 0]

# 5. Feature Engineering
# Create TotalPrice column
df['TotalPrice'] = df['Quantity'] * df['UnitPrice']

# Group by CustomerID to get aggregated customer-level data
customer_data = df.groupby('CustomerID').agg({
    'InvoiceNo': 'nunique',     # Number of orders
    'Quantity': 'sum',          # Total quantity purchased
    'TotalPrice': 'sum'         # Total amount spent
}).reset_index()

# Rename columns for clarity
customer_data.rename(columns={
    'InvoiceNo': 'NumOrders',
    'Quantity': 'TotalQuantity',
    'TotalPrice': 'TotalSpend'
}, inplace=True)

print("\nAggregated Customer Data:")
print(customer_data.head())

# 6. Feature Scaling
scaler = StandardScaler()
X_scaled = scaler.fit_transform(customer_data[['NumOrders', 'TotalQuantity', 'TotalSpend']])

# 7. Finding the optimal number of clusters using the Elbow Method
wcss = []
for i in range(1, 11):
    kmeans = KMeans(n_clusters=i, random_state=42)
    kmeans.fit(X_scaled)
    wcss.append(kmeans.inertia_)

# Plot the Elbow Curve
plt.figure(figsize=(8, 5))
plt.plot(range(1, 11), wcss, marker='o')
plt.title('Elbow Method to Determine Optimal Clusters')
plt.xlabel('Number of Clusters')
plt.ylabel('WCSS')
plt.grid()
plt.show()

# 8. Apply KMeans Clustering
# Let's assume we choose 4 clusters based on the elbow curve
kmeans = KMeans(n_clusters=4, random_state=42)
```

```
customer_data['Cluster'] = kmeans.fit_predict(X_scaled)


# 9. Final segmented customer data
print("\nCustomer Segments:")
print(customer_data.head())


# 10. Visualize the Clusters
plt.figure(figsize=(10, 6))
sns.scatterplot(
    data=customer_data,
    x='TotalSpend',
    y='TotalQuantity',
    hue='Cluster',
    palette='Set2',
    s=100
)
plt.title('Customer Segmentation based on Spend and Quantity')
plt.xlabel('Total Spend')
plt.ylabel('Total Quantity Purchased')
plt.legend(title='Cluster')
plt.grid()
plt.show()
# 11. (Optional) Save the Segmented Customers to a new CSV
customer_data.to_csv('segmented_customers.csv', index=False)
print("\nSegmented customer data saved as 'segmented_customers.csv'.")
```

OUTPUTS



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RAM
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Choose Files 9. Custome…mmerce.csv
Elbow Method to Determine Optimal Clusters
12000
10000
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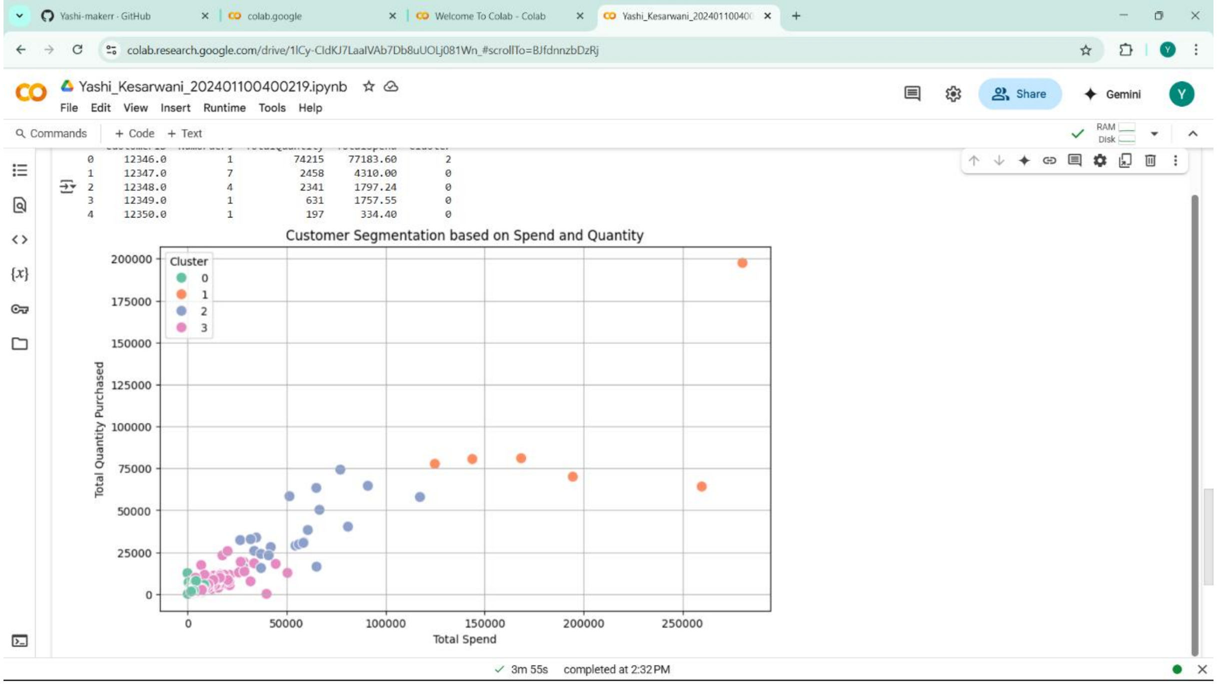
- **9. Customer Segmentation in E-commerce.csv**(text/csv) - 44496850 bytes, last modified: 4/18/2025 - 100% done

```
Saving 9. Customer Segmentation in E-commerce.csv to 9. Customer Segmentation in E-commerce (1).csv
Original Dataset:
  InvoiceNo StockCode                          Description  Quantity  \
0    536365    85123A   WHITE HANGING HEART T-LIGHT HOLDER         6
1    536365     71053                  WHITE METAL LANTERN         6
2    536365    84406B       CREAM CUPID HEARTS COAT HANGER         8
3    536365    84029G  KNITTED UNION FLAG HOT WATER BOTTLE         6
4    536365    84029E       RED WOOLLY HOTTIE WHITE HEART.         6

    InvoiceDate  UnitPrice  CustomerID         Country
0  12/1/10 8:26       2.55     17850.0  United Kingdom
1  12/1/10 8:26       3.39     17850.0  United Kingdom
2  12/1/10 8:26       2.75     17850.0  United Kingdom
3  12/1/10 8:26       3.39     17850.0  United Kingdom
4  12/1/10 8:26       3.39     17850.0  United Kingdom

Aggregated Customer Data:
   CustomerID  NumOrders  TotalQuantity  TotalSpend
0     12346.0          1          74215    77183.60
1     12347.0          7           2458     4310.00
2     12348.0          4           2341     1797.24
3     12349.0          1            631     1757.55
4     12350.0          1            197      334.40
```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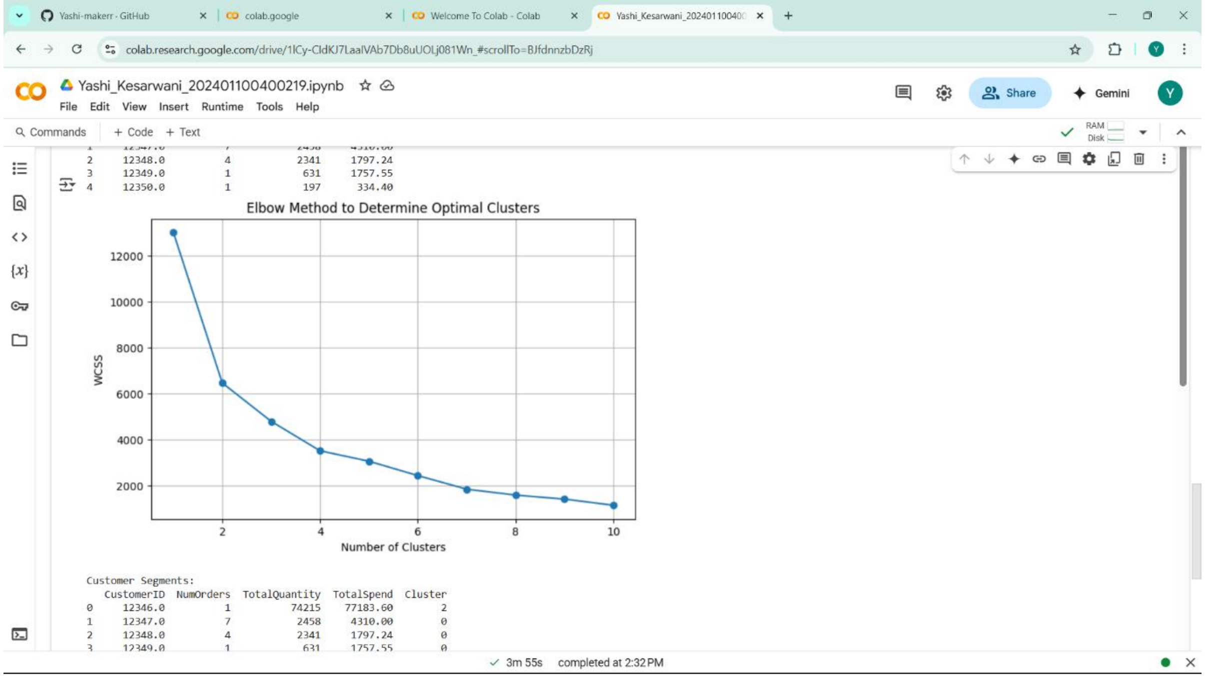
```
   0     12346.0         1          74215     77183.60        2
   1     12347.0         7           2458      4310.00        0
   2     12348.0         4           2341      1797.24        0
   3     12349.0         1            631      1757.55        0
   4     12350.0         1            197       334.40        0
```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```
   2     12348.0         4           2341      1797.24
   3     12349.0         1            631      1757.55
   4     12350.0         1            197       334.40
```

Elbow Method to Determine Optimal Clusters
12000
10000
8000
6000
4000
2000
WCSS
2
4
6
8
10
Number of Clusters

```
Customer Segments:
   CustomerID  NumOrders  TotalQuantity  TotalSpend  Cluster
0     12346.0          1          74215    77183.60        2
1     12347.0          7           2458     4310.00        0
2     12348.0          4           2341     1797.24        0
3     12349.0          1            631     1757.55        0
```

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References/Credits

- Dataset: E-commerce Transaction Dataset (provided during the exam).
- Libraries used:
    - **Pandas** for data manipulation
    - **NumPy** for numerical operations
    - **Matplotlib** and **Seaborn** for visualization
    - **Scikit-learn** for clustering (KMeans) and scaling (StandardScaler)
- Google Colab for running the code.
- CODE : CHATGPT